

CLAIMS

What is claimed is:

1        1. A method for operating an integrated circuit having an image sensor with at least one photoelement  
2 comprising the steps of:

3        (a) generating charge by the photoelement; and

4        (b) applying at least a first portion of the charge generated by the photoelement to other circuitry to  
5 reduce consumption of power from a power supply.

1        2. The invention of claim 1, wherein the integrated circuit is powered by the power supply.

1        3. The invention of claim 1, wherein the photoelement is a photodiode, a phototransistor, a photogate,  
2 photo-conductor, a charge-coupled device, a charge-transfer device, or a charge-injection device.

1        4. The invention of claim 1, wherein the other circuitry is implemented within the integrated circuit.

1        5. The invention of claim 1, wherein step (a) is a standby mode for the image sensor.

1        6. The invention of claim 1, wherein step (a) is an integration step of a normal operation mode for the  
2 image sensor.

1        7. The invention of claim 6, wherein step (b) comprises the steps of:

2        (1) transferring the first portion of the charge from the photoelement to a storage device during a reset  
3 step of the normal operation mode for the image sensor; and

4        (2) applying the first portion of the charge from the storage device to the other circuitry during a  
5 standby mode for the image sensor.

1        8. The invention of claim 7, wherein:

2        during a first phase of the reset step of the normal operation mode, the first portion of the charge is  
3 transferred from the photoelement to the storage device; and

4        during a second phase of the reset step of the normal operation mode, a second portion of the charge is  
5 discharged from the photoelement.

1        9. The invention of claim 8, wherein at least one control signal is generated to transition between the  
2 first phase and the second phase of the reset step.

1 10. The invention of claim 9, wherein voltage across the storage device is detected to generate the  
2 control signal.

1 11. The invention of claim 9, wherein the control signal is generated after a specified time interval.

1 12. The invention of claim 9, wherein current across the other circuitry is detected to generate the  
2 control signal.

1 13. The invention of claim 7, wherein:  
2 during a first phase of the standby mode, power is applied to the other circuitry by the storage device;  
3 and  
4 during a second phase of the standby mode, power is applied to the other circuitry by the power  
5 supply.

1 14. The invention of claim 13, wherein at least one control signal is generated to transition between the  
2 first phase and the second phase of the standby mode.

1 15. The invention of claim 14, wherein voltage across the storage device is detected to generate the  
2 control signal.

1 16. The invention of claim 14, wherein the control signal is generated after a specified time interval.

1 17. The invention of claim 14, wherein current across the other circuitry is detected to generate the  
2 control signal.

1 18. The invention of claim 7, wherein the storage device is a capacitor implemented externally to the  
2 integrated circuit.

1 19. A circuit comprising:  
2 (a) an image sensor having at least one photoelement implemented in an integrated circuit; and  
3 (b) other circuitry, wherein the photoelement generates charge that is applied to the other circuitry to  
4 reduce consumption of power from a power supply.

1 20. The invention of claim 19, wherein the circuit is powered by the power supply.

1 21. The invention of claim 19, wherein the photoelement is a photodiode, a phototransistor, a  
2 photogate, photo-conductor, a charge-coupled device, a charge-transfer device, or a charge-injection  
3 device.

1 22. The invention of claim 19, wherein the other circuitry is implemented within the integrated circuit.

1 23. The invention of claim 19, further comprising a storage device, wherein:  
2 during a reset step of the normal operation mode for the image sensor, the circuit is configured to  
3 transfer at least a first portion of the charge from the photoelement to the storage device; and  
4 during a standby mode for the image sensor, the circuit is configured to apply the first portion of the  
5 charge from the storage device to the other circuitry.

1 24. The invention of claim 23, wherein:  
2 during a first phase of the reset step, the circuit is configured to transfer the first portion of the charge  
3 from the photoelement to the storage device; and  
4 during a second phase of the reset step, the circuit is configured to discharge a second portion of the  
5 charge from the photoelement.

1 25. The invention of claim 24, further comprising a control circuit configured to generate at least one  
2 control signal to transition between the first phase and the second phase of the reset step.

1 26. The invention of claim 25, wherein the control circuit is configured to detect voltage across the  
2 storage device to generate the control signal.

1 27. The invention of claim 25, wherein the control circuit is configured to generate the control signal  
2 after a specified time interval.

1 28. The invention of claim 25, wherein the control circuit is configured to detect current across the  
2 other circuitry to generate the control signal.

1 29. The invention of claim 23, wherein:  
2 during a first phase of the standby mode, the circuit is configured to apply power to the other circuitry  
3 by the storage device; and  
4 during a second phase of the standby mode, the circuit is configured to apply power to the other  
5 circuitry by the power supply.

1 30. The invention of claim 29, further comprising a control circuit configured to generate at least one  
2 control signal to transition between the first phase and the second phase of the standby mode.

1 31. The invention of claim 30, wherein the control circuit is configured to detect voltage across the  
2 storage device to generate the control signal.

1 32. The invention of claim 30, wherein the control circuit is configured to generate the control signal  
2 after a specified time interval.

1 33. The invention of claim 30, wherein the control circuit is configured to detect current across the  
2 other circuitry to generate the control signal.

1 34. The invention of claim 23, wherein the storage device is a capacitor implemented externally to the  
2 integrated circuit.

1 35. The invention of claim 23, further comprising:  
2 a first set of one or more switches (e.g., **324** and **330** of Fig. 3) configured to selectively connect the  
3 storage device to the other circuitry; and  
4 a second set of one or more switches (e.g., **326** and **328**) configured to selectively connect the power  
5 supply to the other circuitry.

1 36. The invention of claim 35, wherein:  
2 the first set of one or more switches comprises:  
3 a first switch (e.g., **322**) configured between the storage device and the photoelement;  
4 a second switch (e.g., **324**) configured between the storage device and a first terminal of the other  
5 circuitry ;  
6 a third switch (e.g., **332**) configured between the storage device and a first terminal of the power  
7 supply; and  
8 a fourth switch (e.g., **330**) configured between the storage device and a second terminal of the  
9 other circuitry; and  
10 the second set of one or more switches comprises:  
11 a fifth switch (e.g., **326**) configured between the first terminal of the other circuitry and a second  
12 terminal of the power supply, and  
13 a sixth switch (e.g., **328**) configured between the second terminal of the other circuitry and the first  
14 terminal of the power supply, wherein:

15 during a first phase of the reset step of the normal operation mode, the first, third, fifth, and sixth  
16 switches are closed and the second and fourth switches are open;  
17 during a second phase of the reset step of the normal operation mode, the first, second, third, and  
18 fourth switches are open and the fifth and sixth switches are closed;  
19 during a first phase of the standby mode, the first, third, fifth, and sixth switches are open and the  
20 second and fourth switches are closed; and  
21 during a second phase of the standby mode, the first, second, third, and fourth switches are open and  
22 the fifth and sixth switches are closed.

1 37. The invention of claim 19, further comprising:

2 a first set of one or more switches (e.g. 422 and 424 of Fig. 4) configured to selectively connect the  
3 photoelement to the other circuitry;  
4 a second set of one or more switches (e.g. 420) configured to selectively connect the photoelement to  
5 the power supply.

1 38. The invention of claim 37, wherein:

2 the first set of one or more switches comprises:

3 a first switch (e.g. 422) configured between the negative node of the photoelement and a first  
4 terminal of the other circuitry;

5 a second switch (e.g. 424) configured between the positive node of the photoelement and a second  
6 terminal of the other circuitry; and

7 the second set of one or more switches comprises:

8 a third switch (e.g. 420) configured between the negative node of the photoelement and the  
9 negative power supply, wherein:

10 during the standby mode, the first and second switches are closed and the third switch is open;

11 during normal operation, the first and second switches are open and the third switch is closed.